Institute for Fiscal Studies

A dynamic perspective on how the UK personal tax and benefit system affects work incentives and redistributes income

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A dynamic perspective on how the UK personal tax and benefit system affects work incentives and redistributes income[1]

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Executive summary

- This briefing note summarises a project that took a life-cycle perspective to understand how taxes and benefits affect incentives to work and earn more, and the way in which they redistribute income. It analysed the simulated lifetimes of women (and their families) whose characteristics are taken from survey data and whose behaviour is derived from a model of individual decision-making that broadly replicates what is actually observed amongst real individuals in the UK.

Work incentives

- The effect of taxes and benefits on work incentives is commonly assessed using the marginal effective tax rate (METR) and the participation tax rate (PTR). Both measure the fraction of a rise in earnings that is lost to extra taxes and lower benefits – the former for an incremental rise in earnings and the latter for the rise in earnings from moving into work.
- Family circumstances have a large impact on the work incentives faced by women. Lone parents tend to face the highest METRs, but low PTRs, reflecting the relatively generous amount of in-work support that is then means-tested away as earnings rise. Women in childless couples generally enjoy the strongest work incentives, because such women are unlikely to be entitled to in-work support and because they are unlikely to be entitled to out-of-work benefits were they not to work.

[1] We are very grateful to Alex Beer, Jennifer Bradley, Juliet Clarke, Christoph Erben, Saranna Fordyce, Jonathan Gillham, Ivan Mathers, Kate Mieske, Stefania Porcu, Matthew Whittaker and Edward Zamboni for discussing our research and its policy implications. We greatly benefited from discussions with Richard Blundell, Costas Meghir, Cormac O'Dea and participants in seminars at the University of Copenhagen, IZA, IFS and ISER. Financial support from the ESRC/HMRC grant number RES-194-23-0016 is gratefully acknowledged. The usual disclaimer applies. Data from the British Household Panel Survey (BHPS) were supplied by the UK Data Archive. Neither the original collectors of the data nor the Archive bear any responsibility for the analysis or interpretations presented here.

Women in couples with children face METRs that can be higher than those for women in couples without children, but not as high as those for working lone parents, and they tend to face higher PTRs than lone parents or women in couples without children.

- But family circumstances do not remain constant, and this means that there is considerable variability in work incentives across individuals' lives. For example, there are large changes in the fraction of women in work facing very high METRs as women age, with the 75th percentile of METRs for the low-education group rising by well over 20 percentage points between ages 20 and 40, before falling.
- A more complete impression of how the tax and benefit system affects work incentives is given by taking into account the future consequences of working today (e.g. more experience leading to higher wages) and the possibility that work decisions tomorrow may change as a result. For some women, our impression of whether taxes and benefits weaken work incentives is affected considerably by taking this dynamic viewpoint. In particular, the true incentive to work facing lone mothers may be weaker, on average, than a static analysis suggests, partly because lone mothers will not all be lone mothers in the future and partly because lone mothers tend to face strong incentives to work but weak incentives to earn more. In general, across different levels of education, it is for low-education women that the static and forward-looking measures are most likely to differ.

Inequality and redistribution

- Disparities in gross income are particularly marked during the main child-rearing years and are largest for those with relatively low education. The birth of children, family transitions and their impact on women's labour market behaviour are at the root of this pattern. But the UK tax and benefit system is particularly effective at reducing these large inequalities, particularly for women with low education.
- A substantial proportion of lifetime disparities (about 35 per cent) are established at the beginning of working life, driven by characteristics such as wealth, education and ability. A smaller proportion of them arise due to family circumstances experienced throughout women's lives, especially lone motherhood. But we find that the UK tax and benefit system is particularly good at ensuring that lone motherhood does not lead to persistent inequalities in lifetime income.
- Changes to the UK tax and benefit system over the last two decades have strengthened its ability to reduce inequalities in lifetime income. The single most important change was the increase in work-contingent support for low-income families with children that began with the working families' tax credit. This was especially effective in reducing inequality among women in the low-education group because it was targeted at those with low income and it increased employment, thus reducing inequality in both gross and net income. Because time out of the labour market can have permanent effects on future earnings, encouraging women to work when children are present can reduce lifetime inequalities as well as cross-sectional ones.

1. Introduction

To make effective tax and benefit policy, it is essential to have a clear understanding of the mechanisms driving individuals' decisions to work and acquire human capital, and how the tax and benefit system influences these decisions. This briefing note summarises results from a project that aimed to provide a richer understanding of the impact of the tax and benefit system by taking a life-cycle perspective.[2] We focus on two questions:

- How does the UK tax and benefit system affect incentives to work and earn more?
- By how much does the UK tax and benefit system redistribute income from rich to poor?

These are important issues that have been studied for several decades, but most work in this area has taken a snapshot view, comparing, for example, the welfare benefits people might get at a point in time if they did not work with their take-home pay in a job, or analysing the distribution of households' usual monthly income in the UK. Such work ignores two important phenomena:

- First, there is a great deal of change in individuals' circumstances as they age. For example, a woman graduating from university today will probably be single and not have children; in 10 years' time, that woman might be married with children; in 20 years' time, she could be raising children as a lone mother; and in 30 years' time, she might be living in a household with no children once more. Moreover, such variation is likely to be associated with substantial changes to work patterns and earnings across life. As a result, individuals will tend to look better off at some points in their life and less well off at others. And since taxes and benefits depend on both earnings and family circumstances, there will also be periods when the tax and benefit system significantly weakens work incentives and does substantial amounts of redistribution, and other times when the effects are much smaller.

[2] Full results are contained in M. Brewer, M. Costa Dias and J. Shaw, 'How taxes and welfare distort work incentives: static, lifecycle and dynamic perspectives', IFS, mimeo, 2012a, and M. Brewer, M. Costa Dias and J. Shaw, 'Lifetime inequality and redistribution', IFS, mimeo, 2012b.

These changes over the life cycle are missed by the standard 'snapshot' approach of measuring incomes or work incentives (including the work previously produced by us and colleagues at IFS).

- Second, many important decisions people make during their life have long-term consequences, not only determining their income today but also affecting the options available to them in the future. This is obviously true about having children, or investing in human capital through education or training. Decisions to work part-time or not work at all, compared with working full-time, might also affect earnings or opportunities in the future. Moreover, individuals are likely to take some account of these future consequences when making decisions. This means that when the tax and benefit system affects people's choices about how much to work or whether to invest in human capital, the implications will be felt not just in the current period but also in the future. It also means that forward-looking individuals will make choices today based, in part, on their expectations of the tax and benefit system in future. Again, this will not be captured by a snapshot approach.

To address the first of these, some researchers have tried to follow people across their lives, measuring living standards over periods longer than a month or a year. Lack of suitable longitudinal data can often be a problem here. But the second issue is much less frequently addressed because it is not enough simply to follow people: we need to understand how decisions are made so that we can measure what effect taxes and benefits have on behaviour. This requires some form of behavioural model.

We take on both these issues. Our work is based on analysis of the simulated lifetimes of individuals whose characteristics are taken from survey data and whose behaviour is derived from a model of individual decision-making that broadly replicates what we actually observe amongst individuals in the UK. We focus on how the tax and benefit system affects women (and the families in which they live) because previous work has shown them to be more responsive to work incentives than men and because family circumstances are likely to be especially important for their employment decisions. We simulate lifetimes for 22,000 women who end up differing across a wide range of characteristics including education, experience, productivity and family composition, including partner's employment and earnings.

With these data, we do two things. First, Section 2 investigates financial work incentives, demonstrating how a life-cycle perspective alters the impression we get of the financial incentives women face to work and earn more under the UK tax and benefit system. Second, Section 3 turns to redistribution, taking a life-cycle view to address two questions: how well does a modern tax and benefit system, based on annual information, target lifetime inequality? And what elements of the tax and benefit system are most progressive from a lifetime perspective? Section 4 summarises our findings and concludes.

For details of the underlying behavioural model, an overview of the UK tax and benefit system, and further results and explanations, we refer the reader to the full papers detailed in footnote 2.

2. A dynamic impression of how taxes and benefits affect work incentives

Any comprehensive assessment of a personal tax and benefit system must include an analysis of how it affects individuals' financial incentives to work and earn more. Although the literature estimating labour supply models has recognised the dynamic nature of the problem,[3] most previous work investigating the impact of taxes and benefits on financial work incentives has tended to exclude any dynamic considerations: few papers break results down by age, let alone think about how work incentives change over time for given individuals,[4] and the measure of financial work

[3] For example, see Z. Eckstein and K.I. Wolpin, 'Dynamic labour force participation of married women and endogenous work experience', *Review of Economic Studies*, 56(3), 375–90, 1989, and M.P. Keane and K.I. Wolpin, 'The career decisions of young men', *Journal of Political Economy*, 105(3), 473–522, 1997. For a review, see M.P. Keane, 'Labor supply and taxes: a survey', *Journal of Economic Literature*, 49(4), 961–1075, 2010.

[4] The examples we know of that take a life-cycle approach to measuring financial work incentives are M. Evans and L. Williams, *A Generation of Change, A Lifetime of Difference? Social Policy in Britain since 1979*, Policy Press, Bristol, 2009, and M. Evans and J. Eyre, *The Opportunities of a Lifetime: Model Lifetime Analysis of Current British Social Policy*, Policy Press, Bristol, 2004. These papers take the 'specimen families' approach to measuring work incentives, giving hypothetical families a hypothetical life cycle (by specifying the time profiles of family formation and childbearing and of how earnings and employment change through life). Evans and his co-authors are thereby able to analyse how financial work incentives change for some specific families as they age. But the analysis is done only for a small handful of

incentives used is always a static one, in the sense of ignoring future returns from working today (an important exception is studies looking at retirement behaviour, where it has long been recognised that individuals may choose to stay in work for longer in order to increase their pension entitlements in the future).

The results from our project, reported in full in Brewer et al. (2012a),[5] take a first step towards filling this gap in the literature by showing how a life-cycle perspective alters our impression of the effect of the UK tax and benefit system on the financial work incentives women face.

We first analyse a static measure of work incentives, showing a large variation between women in different family types and a large variation as women age. A core theme is that women in different circumstances can face very different work incentives under the current UK tax and benefit system, partly due to the mechanical operation of taxes and benefits (particularly benefits and tax credits that take explicit account of the presence of a partner or children) and partly because changes in family circumstances may change women's capacity for or necessity to work. But as family circumstances are not fixed – and the women in our simulated model experience childbearing and partnership formation and dissolution at rates that are consistent with women's actual behaviour – this implies that women can face very different work incentives at different times of their lives. Furthermore, if working today affects decisions about whether to work tomorrow, then a static measure of the extent to which the tax and benefit system affects work incentives may be misleading. We then show the different impression we get about work incentives when we take a dynamic perspective.

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families, the measures of work incentives used are still static ones, and the life-cycle profiles are generated by the researchers with no explicit link to individuals' actual behaviour.

[5] Full citation in footnote 2.

2.1 A static analysis of how the UK tax and benefit system affects work incentives

This section analyses the usual static measures of financial work incentives (hereafter 'work incentives'). Box 2.1 describes the two measures of work incentives we use – the marginal effective tax rate (METR) and the participation tax rate (PTR).[6]

Box 2.1. Static measures of financial work incentives

We use two static measures of work incentives – the marginal effective tax rate (METR) and the participation tax rate (PTR).

The METR describes what fraction of an incremental change to gross family earnings is lost by the family through increased tax liabilities and reduced benefit entitlements.

$$METR \equiv 1 - \frac{Y_{h+1} - Y_h}{E_{h+1} - E_h}$$

where E is gross family earnings, Y is net family income and the subscript h is hours of work. Gross family earnings is total pre-tax-and-benefit weekly earnings of all adults in the family, and net family earnings subtracts taxes and adds on benefits. We treat childcare costs like a tax liability – an unavoidable cost of working that would not otherwise be incurred. This means the METR reflects the marginal (financial) disincentive to working, rather than only that disincentive that arises through the tax and benefit system. We calculate the METR by increasing weekly hours worked by one hour (requiring extra childcare to be bought for this hour, if relevant). We calculate the METR only for individuals in work, since the PTR is probably the relevant measure of work incentives for those who are unemployed.

The PTR describes what fraction of the change in gross family earnings caused by one individual moving into work is lost by the family in terms of increased tax liability and reduced benefit entitlements.

$$PTR \equiv 1 - \frac{Y_h - Y_0}{E_h - E_0}$$

where E and Y are defined as above, and the 0 and h subscripts mean that the woman works zero and h hours respectively. This is very similar to the METR, except here we consider a large jump in hours worked (from zero hours of work), rather than a one-hour-a-week change (from the observed hours of work for those currently in work). We calculate the PTR for workers at their observed hours and for non-workers at the number of hours our model predicts they would have worked had they been in work.

[6] All results in this section are for our simulated women who live all their lives under the April 2012 UK tax and benefit system. Similar analysis, but for a representative sample of individuals observed in the late 2000s, is done in S. Adam and J. Browne, 'Redistribution, work incentives and thirty years of UK tax and benefit reform', IFS, Working Paper 10/24, 2010.

Figure 2.1 plots cumulative distributions for the METR (for working women) and the PTR (for all women), and Figure 2.2 does this separately for women in different family circumstances. For both graphs, the horizontal axis measures work incentives (METR or PTR) and the vertical axis shows what fraction of women have an METR or PTR below that value. By way of background, Tables 2.1 and 2.2 show which taxes and benefits are responsible, on average, for values of METRs and PTRs lying in different ranges.

More than 70 per cent of working women have an METR of exactly 32% (see Figure 2.1), which Table 2.1 shows is made up of basic-rate income tax (20%) and National Insurance (12%). METRs of over 60% (meaning weak incentives to earn more) tend to be caused by having to pay for childcare and by the loss of working tax credit, child tax credit and housing benefit as earnings rise.[7]

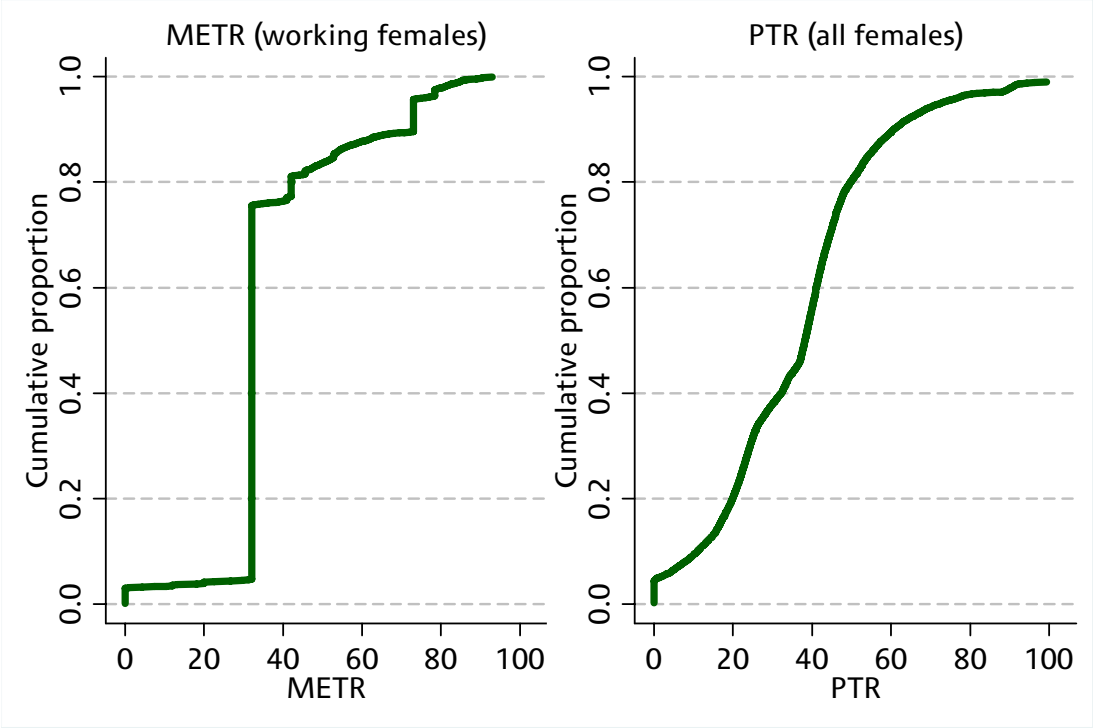
Individuals with relatively strong incentives to work (low PTRs) typically have a working tax credit award that offsets the loss of income support when moving into work. Most women (almost 70 per cent) have a PTR between 20% and 60%, and the key components for these women are income tax, National Insurance and the loss of income support plus, to a lesser extent, childcare, loss of child tax credit and loss of council tax benefit. PTRs in excess of 80% are largely due to the loss of housing benefit and income support when women move into work.

Work incentives vary considerably by family circumstances. Figure 2.2 shows the following:

- Lone parents tend to face the highest METRs, with three-quarters of working lone parents facing an METR over 40%. However, PTRs for this group are relatively low. Both of these facts are due to the relatively generous amount of in-work but means-tested support targeted towards lone parents: the generous in-work support lowers PTRs, but then increases METRs amongst workers as it is withdrawn as earnings rise.

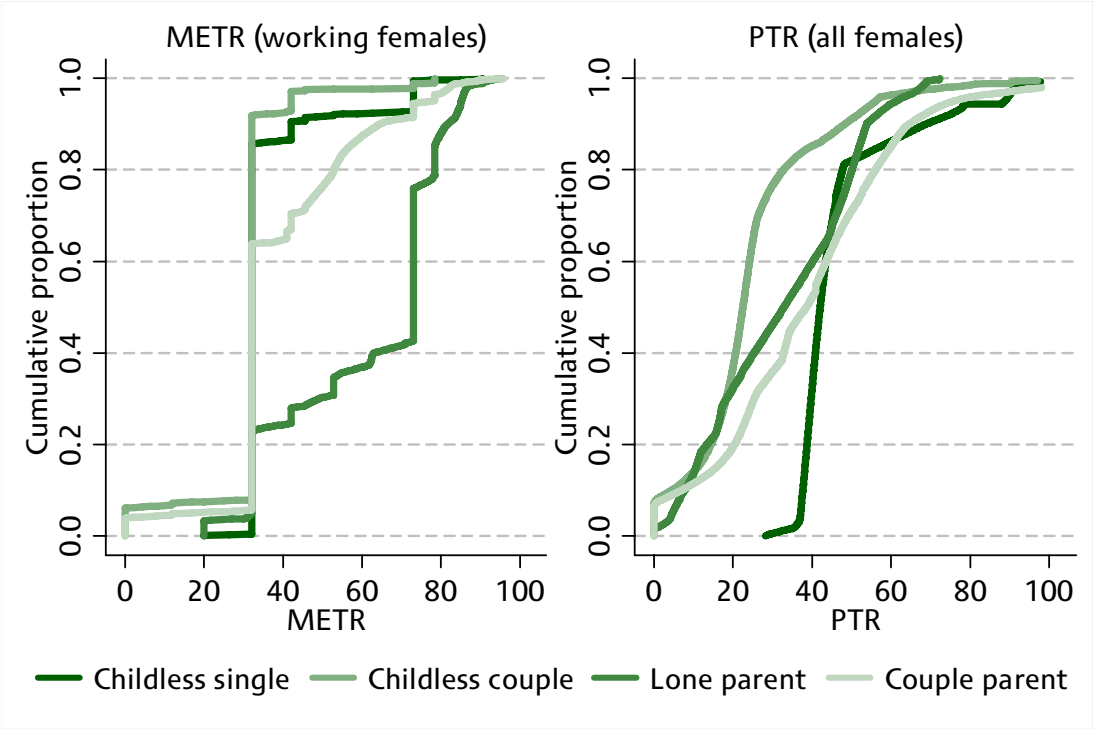
[7] We treat childcare like a tax, and so families who have to pay for childcare must buy more of it to cover additional hours of work. But our model recognises that many families in the UK do not pay for childcare even when they are working and have young children: for details, see Brewer et al. (2012a; full citation in footnote 2).

Figure 2.1. Cross-sectional distributions of the static METR and PTR



Source: Authors' calculations based on simulated data.

Figure 2.2. Cross-sectional distributions of the static METR and PTR, by family type



Source: Authors' calculations based on simulated data.

Table 2.1. Mean composition of METR, by METR band

%	*METR band*				
	≤20	*(20,40]*	*(40,60]*	*(60,80]*	*>80*
Childcare	0.0	0.2	10.7	6.7	29.6
Income tax	0.2	19.9	23.6	18.6	18.7
National Insurance	1.6	11.9	5.9	11.6	11.4
Working tax credit	0.0	–0.1	3.9	24.7	12.7
Child tax credit	0.0	0.0	2.0	9.6	5.1
Income support	0.0	0.0	0.0	0.0	0.0
Housing benefit	0.0	0.0	0.0	0.1	5.2
Council tax benefit	1.8	0.1	1.4	1.2	2.3
Other	0.0	0.0	0.0	0.0	0.5
Total	**3.6**	**32.0**	**47.4**	**72.5**	**85.4**
Share of individuals	4.2	72.2	11.3	10.2	2.2

Notes: For each individual, the METR can be decomposed into a sum across METRs for each income component. This table shows these component METRs averaged across individuals, but where individuals have been split into five bands according to the value of their overall METR (the notation $(x,y]$ in the column headings means greater than x and less than or equal to y).
Source: Authors' calculations based on simulated data.

Table 2.2. Mean composition of PTR, by PTR band

%	*PTR band*				
	≤20	*(20,40]*	*(40,60]*	*(60,80]*	*>80*
Childcare	2.0	2.4	4.1	9.7	4.0
Income tax	4.2	11.7	8.7	6.3	0.2
National Insurance	2.8	7.1	5.5	4.1	0.2
Working tax credit	–16.6	–4.9	1.4	0.6	1.0
Child tax credit	0.4	2.0	5.0	1.9	0.0
Income support	14.9	9.2	15.7	26.6	81.9
Housing benefit	0.1	0.5	1.8	13.4	11.1
Council tax benefit	1.4	1.9	4.5	4.9	3.5
Other	0.7	0.3	0.3	0.3	0.0
Total	**9.9**	**30.4**	**47.0**	**67.9**	**102.0**
Share of individuals	20.2	35.8	33.4	7.2	3.3

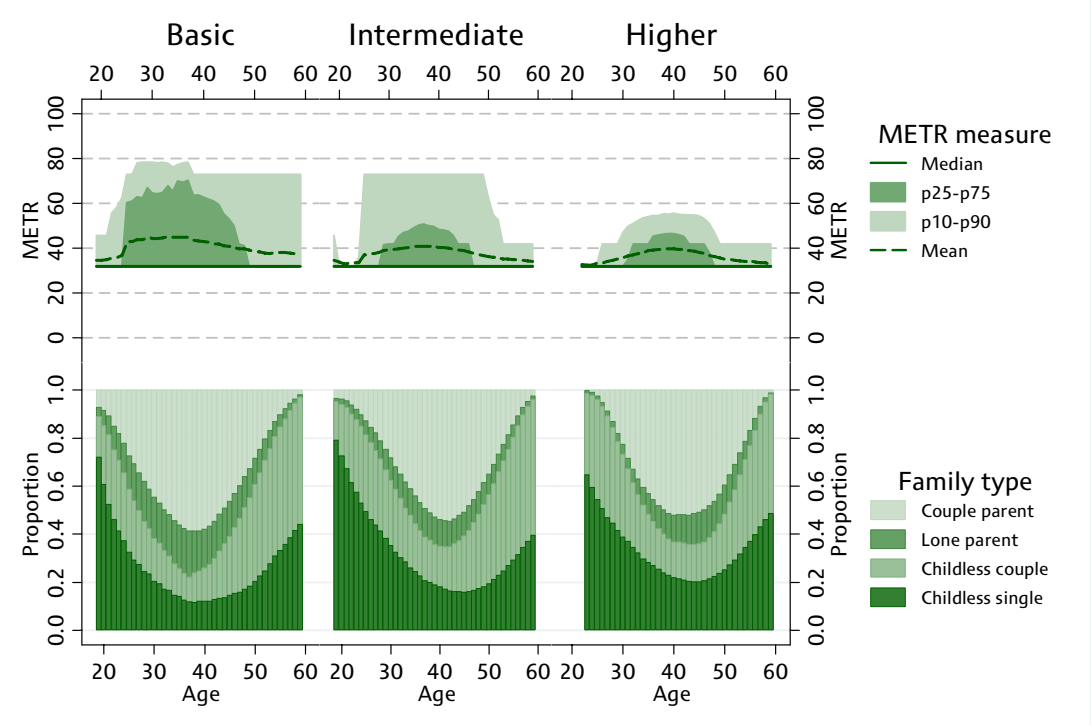
Notes: For each individual, the PTR can be decomposed into a sum across PTRs for each income component. This table shows these component PTRs averaged across individuals, but where individuals have been split into five bands according to the value of their overall PTR (the notation $(x,y]$ in the column headings means greater than x and less than or equal to y).
Source: Authors' calculations based on simulated data.

- Women in childless couples generally enjoy the strongest work incentives: over 90 per cent have METRs of 32% and over three-quarters have a PTR under 30%. This is because such women are unlikely to be entitled to in-work support (the withdrawal of which contributes to high METRs) and because women with partners but no children are unlikely to be entitled to out-of-work benefits, were they not to work, because most of their partners are working.
- Almost all childless single women have PTRs of at least 40%, a consequence of the loss of income support on moving into work, which is only sometimes offset by entitlement to working tax credit in work, and the effect of income tax and National Insurance.
- Women in couples with children face METRs that can be higher than those for women in couples without children, but not as high as those for working lone parents. And women in couples with children tend to face higher PTRs (weaker incentives to work) than lone parents or women in couples without children. This hard-to-characterise pattern partly reflects the large variety of ways in which this group of women can be treated by the tax and benefit system, depending upon the level of earnings of both adults in the couple. At one extreme, high-skilled women with high-earning partners will not be affected by the benefit or tax credit system, and therefore face fairly low METRs and PTRs. But low-skilled women with non-working partners will tend to face extremely high METRs and PTRs, as in-work support is not as generous for couples as it is for lone parents (keeping PTRs high) and because of the loss of tax credits as earnings rise (keeping METRs high).

Changes in the financial incentive to work over the life cycle

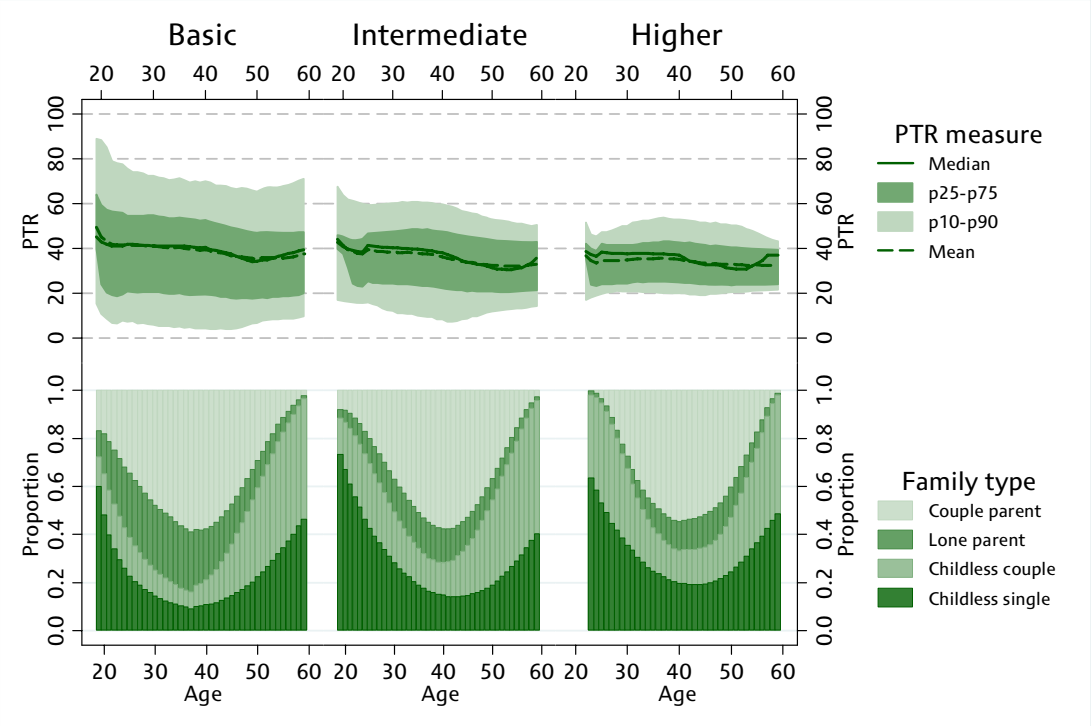
Figure 2.3 shows how the METR for working women changes as they age, analysed separately by the level of women's formal education (we use 'basic', 'intermediate' and 'higher' to stand for the three educational levels considered, meaning 'GCSEs or lower', 'A levels, higher vocational qualifications or equivalent' and 'university degree, equivalent or higher', respectively). The top half of the figure shows the mean and median METR at each age, as well as the interquartile range (p25-p75) and the range between the 10th and 90th percentiles (p10-p90). For information, the bottom half of the figure shows how family circumstances change with age. The figure shows the following:

Figure 2.3. Distribution of METRs and family types for working women across the life cycle, by education



Source: Authors' calculations based on simulated data.

Figure 2.4. Distribution of PTRs and family types for all women across the life cycle, by education



Source: Authors' calculations based on simulated data.

- Although the 10th to 50th percentiles of METRs remain constant at 32% throughout life (corresponding to basic-rate income tax plus National Insurance), there are substantial changes in the fraction with high METRs as individuals age, with this peaking when women are in their 30s. For example, for women in the low-education group, the 75th percentile of METRs rises by well over 20 percentage points between ages 20 and 40, before falling back. This period coincides with a large rise in the share of families with children, and Figure 2.2 showed that women with children tend to have higher METRs than women without.
- The life-cycle patterns are not uniform across different education groups: METRs are much more variable over the life cycle and at any particular age, and much more likely to be high, for low-educated women than they are for the high education group.

Figure 2.4 repeats the analysis for the PTRs for all women. It shows a slight downward trend and a narrowing of the distribution over the life cycle. As with the METR, PTRs are more variable and more likely to be high for low-educated women.

These figures give us insight into how the impact of the tax and benefit system on women's work incentives changes as they age. But they do not tell us how these incentives evolve over the life cycle for particular women. In Brewer et al. (2012a), we show that there is a great deal of change in these incentive measures for individual women, with two-thirds of the variability in METRs and PTRs that we observe across the population being due to differences across the life cycle rather than differences between individuals. This means that women tend not to be stuck permanently with weak work incentives. For example, less than 30 per cent of women aged 25–29 with a PTR exceeding 80% still have a PTR that high 10 years later. A lot of this change is due to changes in family circumstances, so the extent of change tends to decline as women age because family circumstances change less often.

2.2 A dynamic measure of work incentives: the forward-looking participation tax rate

The static view of work incentives presented so far (and analysed in other papers on this topic) ignores the fact that part of the return to working today may be realised tomorrow.

In our model, there are two channels by which decisions today affect options in the future – hourly wages and savings. Working today increases people's experience, which is rewarded by higher hourly wages in the future.[8] And part of the income earned from working today might be saved, which means there is more unearned income in future years.

This then suggests two mechanisms by which the dynamic post-tax-and-benefit return to working might differ from the static return:

- Higher hourly wages in the future might be treated very differently by the tax and benefit system from the way additional current earnings are (indeed, the results in the previous subsection point to substantial variability over women's lifetimes).
- A higher hourly wage may affect future decisions: it should make working in the future more attractive, but might also make it less necessary (as women can work less and still earn the same amount).

If individuals are forward-looking – taking into account these possible future implications – then it is important to allow for this when measuring work incentives.

In this subsection, we present results for a new measure of work incentives we have devised that takes into account these dynamic considerations – the forward-looking PTR. Its construction is described in Box 2.2 (and in more detail in section 2 of Brewer et al. (2012a)).

The obvious question is 'Why would the static and forward-looking measures differ?'. In Brewer et al. (2012a), we show that the forward-looking PTR can be expressed as a (weighted) average of today's PTR and future tax rates (which are either PTRs or METRs). To gain more insight, it helps to think of two cases:

1. *A woman's future work decisions are not affected by the current work choice.* In this case, the forward-looking PTR is a weighted average of today's PTR and of METRs from all future periods in which the individual works. Whether the forward-looking PTR for such a woman exceeds the static PTR will therefore depend upon the time profile of

[8] The rate at which experience accumulates depends on the level of education and on whether individuals work full- or part-time; the wage return to experience depends on education. These patterns match what we observe in hourly wage profiles based on British Household Panel Survey (BHPS) data.

METRs and their relationship to the static PTR: a forward-looking PTR is more likely to exceed a static PTR, for example, for women whose static METR exceeds the static PTR or whose METR increases with age.

2. *A woman's future work decisions are affected by the current work choice.* In this case, the forward-looking PTR is a (weighted) average of today's PTR, future METRs (for all future periods in which the individual works regardless of current work choice) and appropriately-defined PTRs (for all future periods in which the work choice is affected by current work choice). Therefore, the forward-looking PTR is most likely to exceed the static PTR for women whose PTR is higher in the future, whose static METR exceeds the static PTR or whose METR rises with age.

As the forward-looking measure of work incentives can differ from the usual static measure, it is likely that the two will give us a different impression about how taxes and benefits affect work incentives and about

Box 2.2. A forward-looking participation tax rate

The forward-looking PTR measures what fraction of the change in current and future earnings caused by one individual moving into work today is lost by the family through current and future increases in tax liabilities and reductions in benefit entitlements.

$$\textit{Forward-looking PTR} \equiv 1 - \frac{\overline{Y_h} - \overline{Y_0}}{\overline{E_h} - \overline{E_0}}$$

where $\overline{E}$ and $\overline{Y}$ are (discounted) gross family earnings and net family income across the remainder of working life,[a] and the 0 and h subscripts mean that the woman works zero and h hours in the current period respectively. Notice that this is identical to the standard PTR except that we replace current measures of gross and net earnings with lifetime measures.

This measure of work incentives is consistent with the way in which forward-looking individuals make decisions, since it takes into account future implications of working today. We calculate the forward-looking PTR using our life-cycle model: we simulate optimal future labour supply choices conditional on the individual not working in the current period, do the same conditional on the individual working in the current period, and then plug the resulting estimates of life-cycle gross earnings and net incomes into the formula above. Note that, just like static measures of work incentives, it can be calculated using any age as the 'current' age. But unlike static measures of work incentives, it is uncertain at the current age, so in what follows we focus on its average (expected) value.

[a] For example, $\overline{E_h} = \sum_{s=0}^{A-a} \left(\frac{1}{1+r}\right)^s E_{a+s|h_a=h}$, where a is the current age, A is the age at the end of working life and r is the real interest rate.

the nature of the women most affected by, say, weak work incentives. We examine these matters in the remainder of this subsection.

How much do the forward-looking PTR and static PTR differ?

Table 2.3 shows how much the forward-looking PTR differs from the static PTR across all of our simulated women. On average across all ages, the forward-looking PTR exceeds the static PTR by 1.5 percentage points (this means that the static PTR is overstating the strength of work incentives).

Table 2.3. Distribution of difference between expected forward-looking PTR and static PTR

% points	***Expected forward-looking PTR – Static PTR***							
	Mean	*Below –10*	*Below –5*	*Below –1*	*Within 1*	*Above +1*	*Above +5*	*Above +10*
All ages	1.5	4.5	9.6	38.6	33.1	28.2	11.2	6.7
Start of working life	–2.3	7.1	21.6	75.3	7.6	17.2	9.4	3.4
Age 25	–1.2	5.0	12.0	50.4	20.4	29.2	12.3	7.1

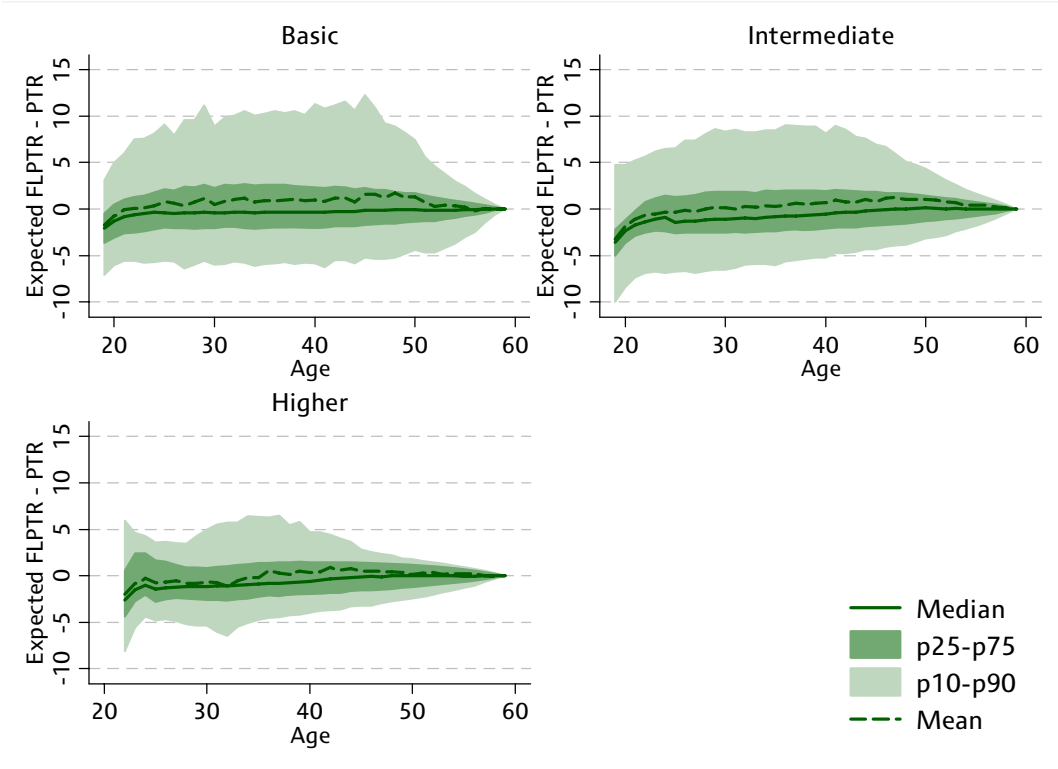
Note: 'Start of working life' means age 22 for those with high education and age 19 for others.
Source: Authors' calculations based on simulated data.

But the distribution is fairly dispersed: more than a fifth of women have a (positive or negative) difference exceeding 5 percentage points (i.e. below –5 or above +5) and more than a tenth have a difference exceeding 10 percentage points. The dispersion is greater at the start of working life (when over 30 per cent of women have a difference exceeding 5 percentage points and over 10 per cent have a difference exceeding 10 percentage points), and the forward-looking PTR becomes closer to the static PTR as individuals age, since there are fewer future periods to create a difference.

Which types of women have especially large or small differences between the forward-looking PTR and static PTR?

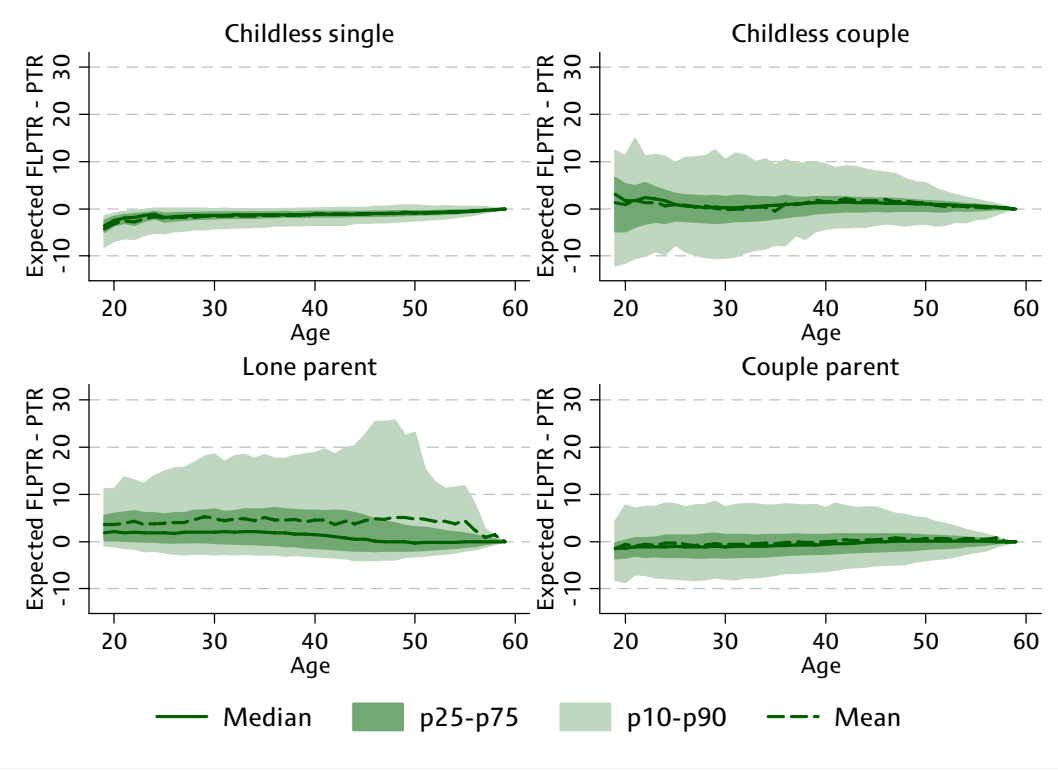
Figure 2.5 plots, by education and age, the mean and various percentiles of the distribution of the difference between the forward-looking PTR and the static PTR (as before, positive numbers mean the forward-looking PTR is greater than the static PTR, indicating weaker dynamic work incentives). In general, differences decline with age. The graph shows that the general

Figure 2.5. Distribution of difference between expected forward-looking PTR and static PTR, by education and age



Source: Authors' calculations based on simulated data.

Figure 2.6. Distribution of difference between expected forward-looking PTR and static PTR, by family type and age



Source: Authors' calculations based on simulated data.

pattern is for the differences to start negative (on average), to turn positive (or less negative) and become more dispersed during child-rearing years (implying that the static measure is suggesting a stronger incentive to work than the forward-looking measure, on average), before becoming much less dispersed from the age of 40. This pattern is much more evident for the basic education group than for the high education group, for whom the differences tend to be much smaller.

Figure 2.6 shows the mean and various percentiles of the distribution of the difference between the expected forward-looking PTR and the static PTR, splitting women by family circumstances. It shows the following:

- Amongst single women with no children, mean and median differences are clearly negative, meaning the conventional static view of work incentives tends to overstate the extent to which the tax and benefit system is weakening work incentives. This is probably because static PTRs tend to be higher for single women than for other groups (as shown in Section 2.1) and many single women without children will expect to experience a change in family circumstances. For this group, then, future PTRs may well be lower than the current PTR. However, the size of any discrepancy tends to be small.
- For lone mothers, mean and median differences are clearly positive, meaning the conventional static view of work incentives may be understating the extent to which the tax and benefit system is weakening work incentives, and the understatement is large for some lone mothers: for example, almost 10 per cent of lone mothers aged 45 have an expected forward-looking PTR that is 20 percentage points higher than their conventional static PTR. This is probably because many lone mothers can expect to experience a change in family circumstances to family types – childless singles and couple parents – that experience higher static PTRs on average than lone parents do (see Section 2.1). For this group, then, future PTRs may well be higher than the current PTR. Furthermore, the METRs faced by lone mothers are often much higher than their PTRs, and so any wage returns to working now will be taxed at much higher rates than the initial move into work. Both will lead to forward-looking PTRs exceeding static PTRs.
- For women in couples with children, the differences between the expected forward-looking PTR and the static PTR are, in general,

smaller than those for lone mothers, and are negative at the mean (implying that the conventional static view of work incentives may be overstating the extent to which the tax and benefit system is weakening work incentives). This probably reflects that the most likely family transitions for this group are to being a lone mother or to being a couple without children, and both tend to have lower PTRs than women in couples with children. For this group, then, future PTRs may well be lower than the current PTR.

- Amongst women in couples without children, mean and median differences are very close to zero, but the distribution is quite wide (and much wider than for single women without children).

3. Lifetime inequality and redistribution

Most inequality studies base their analysis on income measured over short periods. This may produce a misleading picture of the differences in well-being across individuals because incomes change over time in ways that are partly predictable and can be smoothed by borrowing and saving.[9] True economic disparities are therefore more accurately revealed by the distribution of income measured over long periods, in particular the entire life cycle.

The same issues arise when assessing the redistributive impact of taxes and benefits.[10] For example, a snapshot assessment of a benefit such as jobseeker's allowance would suggest it reduces income inequality substantially. But its impact on inequality in incomes measured over a lifetime may be more modest if unemployment is a temporary state affecting many individuals. This means that the amount of redistribution

[9] Empirical studies to date have found that dispersion in income decreases with the length of the accounting period and that income mobility is non-negligible (empirical results for the UK in S. Jarvis and S. Jenkins, 'How much income mobility is there in Britain?', *Economic Journal*, 108, 428–43, 1998, and S. Jenkins, 'Trends in the UK income distribution', in R. Hauser and I. Becker (eds), *The Personal Distribution of Income in an International Perspective*, Springer Verlag, Berlin, 2000).

[10] Recent empirical results in T. Piketty and E. Saez, 'How progressive is the U.S. federal tax system? A historical and international perspective', *Journal of Economic Perspectives*, 21(1), 3–24, 2007, and N. Bengtsson, B. Holmlund and D. Waldenström, 'Lifetime versus annual tax progressivity: Sweden, 1968–2009', Uppsala Center for Fiscal Studies, Working Paper 2012:8, 2012.

performed by the tax and benefit system in any one year will be much greater than the amount of redistribution performed over people's lifetimes, because part of the redistribution achieved in any one year simply represents a redistribution of income between different years of an individual's life.[11]

Our use of simulated data on the family income over the course of life of around 22,000 women provides an ideal setting to address these issues. The simulated data are produced by an estimated life-cycle model of women's education, labour supply and savings.[12] Using simulated data means we can observe individuals over their entire adult lives and we have complete control over the institutional setting. Thus we can isolate the impact of some of its specific features on education, labour supply and, consequently, lifetime inequality. But we do not consider the effects that changes in taxes and benefits may have on family decisions such as marriage and childbearing. The careful estimation of the model means that it replicates well the long-term inequality and income mobility patterns found in actual longitudinal data for the UK, giving us confidence that the model is a good tool to use for studying lifetime inequality.[13]

In this section, we investigate income inequality and redistribution from a life-cycle perspective, assuming that individuals live their lives under the April 2006 UK tax and benefit system (Box 3.1 defines the income measures used throughout). We begin by comparing annual and lifetime inequality, finding that inequality is higher on an annual basis than over the life cycle, but also that more redistribution takes place when measured over the shorter horizon. Nevertheless, the UK tax and benefit system is

[11] This does not imply that one should not care about annual redistribution. It is justified, for instance, if access to credit is limited, thus compromising individuals' ability to transfer money across periods.

[12] The model was originally developed in R. Blundell, M. Costa Dias, C. Meghir and J. Shaw, 'Female labour supply, education and welfare', IFS, mimeo, 2012; it is explained in Brewer et al. (2012b; full citation in footnote 2), especially appendix A.

[13] One caveat is that the analysis excludes state pensions and benefits for those over State Pension Age. By excluding them, our results are biased towards finding relatively more interpersonal redistribution than we would have found otherwise. While this is important for the comparison of annual and lifetime redistribution, it is less of a concern for the study of the redistributive properties of the set of taxes and benefits being considered.

effective at reducing lifetime disparities, particularly amongst low-educated women. The rest of the section shows how this comes about. First, we show that inequality is especially high during years when women are likely to have children and that this is also a period of life when the amount of redistribution achieved by the UK tax and benefit system is particularly high (Section 3.1). Second, we show that changes in women's lives during their child-rearing years and the way these are targeted by the UK tax and benefit system together bring about the most significant contribution to lifetime redistribution (Section 3.2). Third, we look at the main changes to the way the UK tax and benefit system has treated families with children over the last two decades. We find that the expansion of work-contingent benefits that began with the working families' tax credit makes the largest contribution to lifetime redistribution (Section 3.3). This arises not only because these benefits are targeted towards families with low earnings, but also because they induce some women (mostly lone mothers) to work.

Box 3.1. How income is measured

Income is measured at the family level and equivalised for family composition using the modified OECD equivalence scale (1, 0.6 and 0.4 for first adult, second adult and children, respectively). For gross income, we focus on earnings from employment, abstracting from the top 2 per cent of the distribution (for whom income from other sources is important). Net income is gross income less personal taxes plus benefits and tax credits. Lifetime income is the sum across life of equivalised annual income, discounted using the risk-free real interest rate.

Throughout, we use the term *inequality* to signify the dispersion in family income and we use the Gini coefficient to measure such dispersion. *Redistribution* occurs when the tax and benefit system reduces inequality, or (loosely speaking) when it improves the relative position of individuals at the bottom of the income distribution. Under this definition, a pure proportional tax is not redistributive. What is needed is *progressivity* in the tax and benefit system: the *average tax rate* (ATR) needs to be increasing in gross income. (The ATR is the ratio of total family tax liability net of benefit entitlements to gross earned family income.)

3.1 Annual and lifetime inequality

Many studies have found that inequality is higher when assessed with annual income than when assessed with income measured over a longer period. Table 3.1 comes to the same conclusion. This is the result of

natural income and family dynamics that generate income mobility and reduce inequality when one takes a longer perspective. Simply put, not all those with low incomes now will have low incomes in the future.

The table also shows that the UK tax and benefit system reduces inequality in annual income by much more than inequality in lifetime income: the tax and benefit system reduces the Gini coefficient for annual income by 9 percentage points, but for lifetime income only by 6 percentage points. This is because part of the taxes individuals pay goes to fund means-tested benefits that compensate individuals when they have a temporarily low income. Seen from a lifetime perspective, this effectively represents a transfer from one point in an individual's life to another point in that same individual's life, rather than a transfer from the lifetime rich to the lifetime poor. On the other hand, the 6-percentage-point drop in lifetime inequality brought about by the UK tax and benefit system is non-negligible and shows that the system does reduce lifelong disparities.

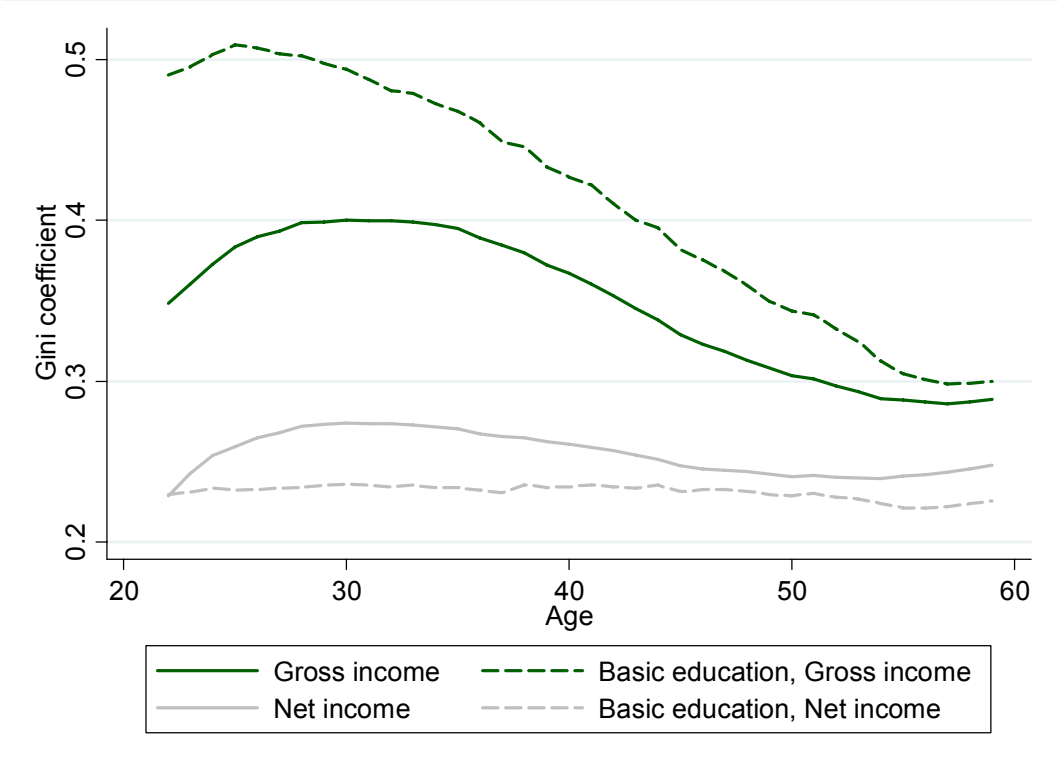
Table 3.1 also presents results that split women into different groups according to their educational qualifications. Inequality in gross income is especially pronounced among low-educated women, both on an annual and a lifetime basis; this is largely a consequence of the high rate of non-employment among this group. But inequality in net income is at similar levels for all three education groups. The UK tax and benefit system is particularly effective at reducing lifelong differences in income among the women with basic educational attainment.

Table 3.1. Annual and lifetime inequality by educational attainment: Gini coefficients

	Gross income		***Net income***	
	Annual	*Lifetime*	*Annual*	*Lifetime*
All population	0.37	0.24	0.28	0.18
Basic education	0.42	0.27	0.24	0.15
Intermediate education	0.32	0.21	0.25	0.16
Higher education	0.28	0.15	0.26	0.13

Notes: Annual Gini coefficients are computed for the pooled sample of annual observations for all women or by educational attainment. 'Basic', 'intermediate' and 'higher' education stand for 'GCSEs or lower', 'A levels, higher vocational qualifications or equivalent' and 'university degree, equivalent or higher', respectively.

Figure 3.1. Gini coefficients over the course of life for gross and net family income



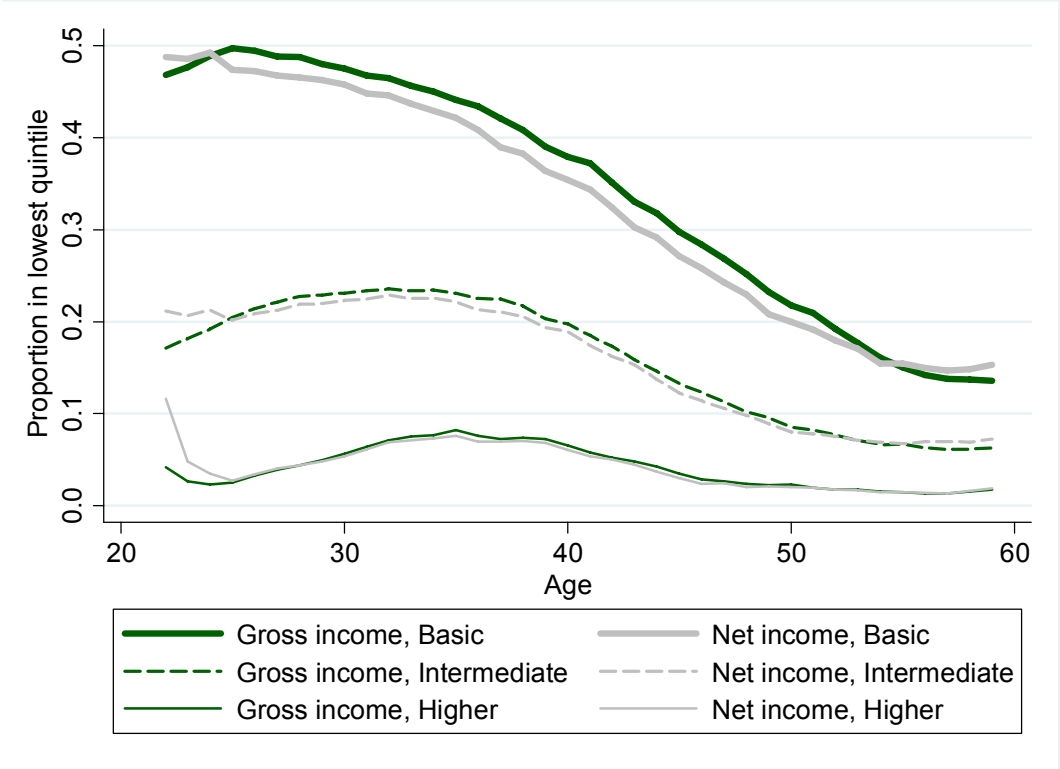
Notes: Gini coefficients computed within women's age groups. 'Basic education' designates women whose educational attainment is 'GCSEs or lower'.

To investigate how inequality builds up over the course of life, Figure 3.1 plots the Gini coefficient for gross and net family income amongst women of a given age, and it shows this both for all women and for just those in the lowest education group. Figure 3.2 shows the incidence of relative low income over the life cycle by educational attainment. Figure 3.1 shows that there is a clear life-cycle pattern to inequality in gross income among all women, with a hump-shape pattern that peaks when women are in their 30s. Women with basic education face especially high levels of inequality in gross income, and the top two lines in Figure 3.2 show that the incidence of relative low income for this group is particularly high when inequality is also at its highest. Given that many women experience motherhood in their 20s and 30s, and given that the group with basic education have a higher childbearing rate at younger ages and a higher risk of becoming a lone mother than the other groups, it seems likely that family transitions and the birth of children, and the impact these have on women's paid employment and earnings, are at the root of this pattern.

Figure 3.1 also shows that the UK tax and benefit system is particularly effective at reducing the large disparities in income experienced by women during the main child-rearing years: although the difference in the Gini coefficient for gross income between early and late life for women with basic education is around 20 percentage points, the differences in their Gini coefficient for net income between early and late life is almost zero.

Overall, then, women with basic education experience more inequality in gross income than other women, and this is particularly acute during their child-rearing years. However, taxes and benefits act to eliminate these disparities, so that inequality in net income for women with basic education is lower than that for other women and displays almost no changes over the life course. This strongly suggests that the way the UK tax and benefit system deals with families with children is crucial in bringing about this lifetime redistribution. We now move to investigate this issue.

Figure 3.2. Proportion of families in the bottom quintile of annual income over the life cycle

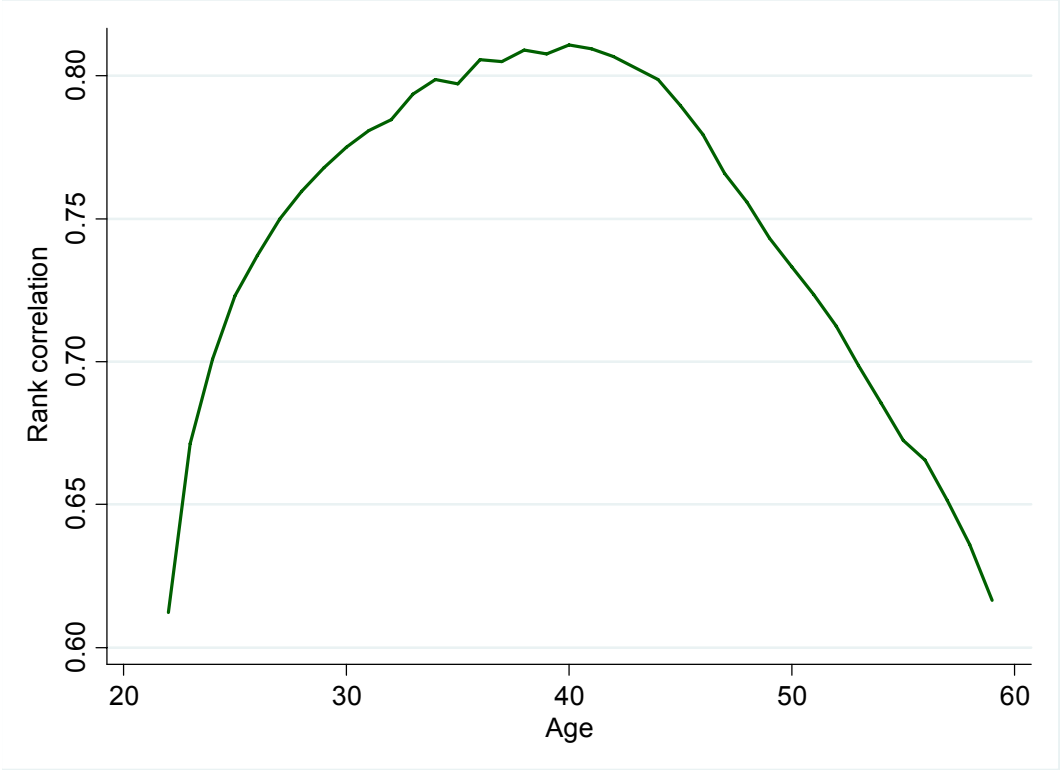


Notes: The quintiles in annual income are computed from the pooled sample of all women over their entire adult life, i.e. they do not vary by age. 'Basic', 'intermediate' and 'higher' stand for the three educational levels considered, meaning 'GCSEs or lower', 'A levels, higher vocational qualifications or equivalent' and 'university degree, equivalent or higher', respectively.

3.2 Sources of lifetime inequality and lifetime redistribution

The previous subsection showed that some periods of women's lives are characterised by large inequalities (particularly for those with basic levels of education) and yet seem to be particularly well protected by the tax and benefit system. But we have not yet established what this means for lifetime inequality and redistribution. It is possible that most of this variation in incomes is short-lived; if so, it would have only a weak relation with persistent differences between individuals, and any redistributive effort to tackle disparities during child-rearing years would have only mild consequences for lifetime inequality.

Figure 3.3. Rank correlation between annual and lifetime gross income, by age

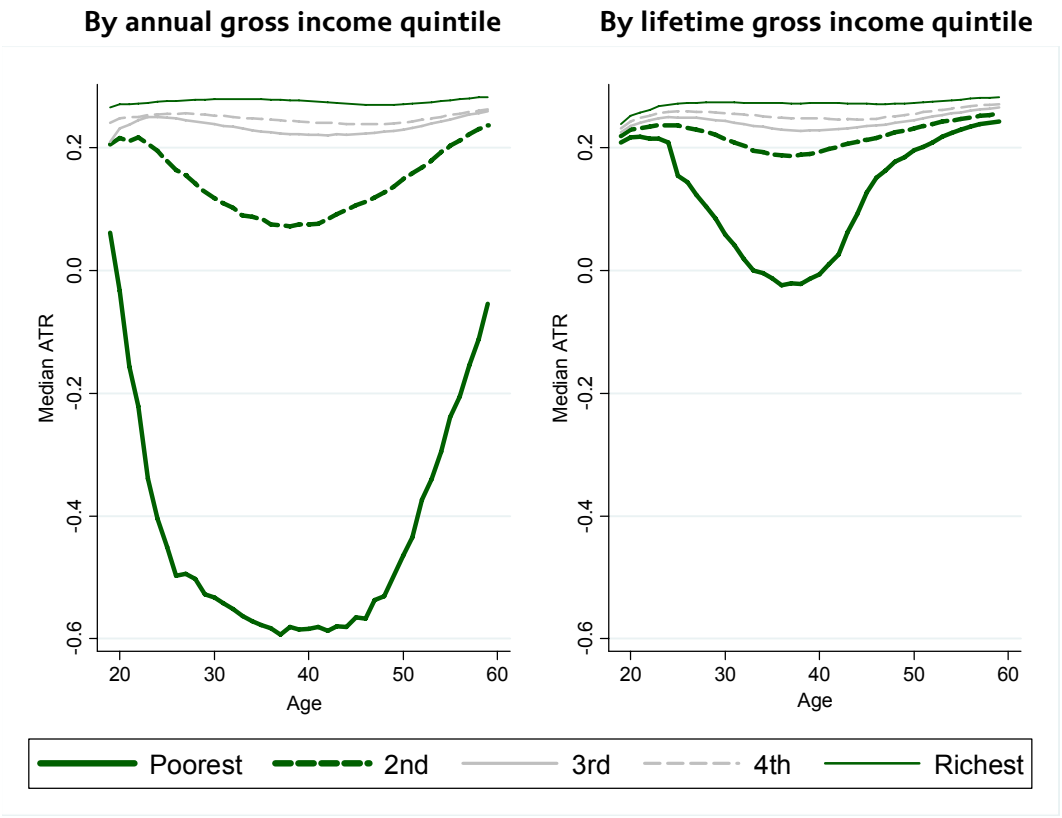


Notes: The rank correlation is the correlation between the rank of each woman in the distribution of annual family income and her rank in the distribution of lifetime income.

Figure 3.3 suggests this is not the case. It plots the correlation between the rank of each woman in the distribution of annual family income and her rank in the distribution of lifetime income, and shows how it changes by age. The graph indicates that gross income at age 40 is a better predictor of gross lifetime income than income at any other age. In general, child-rearing years (when families are at higher risk of low income) are also a

time when gross annual income predicts gross lifetime income well. This supports the hypothesis that a high proportion of lifetime disparity is established during this period, when non-employment is relatively common.

Figure 3.4. Median average tax rate over the life cycle, by quintile of the distribution of annual and lifetime gross income



Notes: Women are ranked by their positions in the distributions of annual (left-hand side) and lifetime (right-hand side) income and are split into equally-sized groups. Each line represents the median average tax rate within the respective group by age of the woman. The average tax rate is the ratio of family tax liability net of benefits to family gross earnings.

Figure 3.4 further suggests that taxes and benefits affecting the main child-rearing years are particularly redistributive from a lifetime perspective. It plots median average tax rates by age,[14] split by annual gross income quintile in the left-hand graph and lifetime gross income quintile in the right-hand graph.[15] In a progressive tax and benefit system, the average

[14] The average tax rate is the ratio of family tax liability net of benefits to family gross earnings.

[15] The composition of each quintile group therefore remains constant with age for the right-hand graph but not for the left-hand graph.

tax rate should rise as income rises. The left-hand graph shows that the UK tax and benefit system is especially generous towards those at the bottom of the annual income distribution, especially so during the main child-rearing years (when individuals in the second-lowest quintile also benefit from especially low average tax rates).

The right-hand graph repeats this analysis, but splits people according to their position in the distribution of lifetime income. It shows a more compressed distribution of tax rates over the life cycle than when considering annual income, fully consistent with our finding that the tax and benefit system reduces the lifetime income Gini coefficient by less than it does the annual income Gini. But strong progressivity from a lifetime perspective can still be seen at the bottom of the income distribution during child-rearing years. Indeed, if it were not for this period of life, the UK tax and benefit system would be close to neutral from a lifetime perspective, as the average tax rates at other ages vary little across the lifetime income quintile groups.[16]

To establish more clearly the sources of lifetime inequality, including the role that family history has in determining differences between individuals and how the tax and benefit system tackles them, we can decompose inequality into some of its determinants.[17] We distinguish between the roles played by women's initial assets and preferences for paid work, their educational attainment, and different family circumstances (which obviously change over their lives). Table 3.2 shows that educational attainment and women's innate characteristics account for just over a third (34 per cent) of the variation in lifetime income (in logs). But family circumstances also account for a non-negligible 18 per cent of the variance in family income, even after controlling for initial conditions and education. Of all aspects of family circumstances, lone motherhood makes

[16] Retirement pensions would generally make the tax and benefit system look less progressive from a lifetime perspective, and their inclusion in the analysis would make the progressivity of the right-hand graph less visible.

[17] We adopt the simple regression-based decomposition methodology suggested by G.S. Fields, 'Accounting for income inequality and its change: a new method, with application to the distribution of earnings in the United States', in S.W. Polachek (ed.), *Worker Well-Being and Public Policy*, Research in Labor Economics 22, Emerald, 2003, following A.F. Shorrocks, 'Income inequality and income mobility', *Journal of Economic Theory*, 19(2): 376–93, 1978.

Table 3.2. Factor decomposition of variance in lifetime income: percentage explained by various lifetime dimensions

	Initial conditions	***Education***	***Family history***			
			Partner	*Children*	*Lone mother*	*Total*
Gross income	13.2%	20.9%	3.4%	6.0%	8.7%	18.1%
Net income	15.3%	24.2%	3.1%	7.2%	1.1%	11.4%

Notes: Decomposition of the variance in lifetime income uses a standard Fields regression method (see footnote 17). In total, it explains over 50% of the variance in lifetime income; alternative specifications produced similar results.

the biggest contribution, explaining just under 9 per cent of the variance or half of the 18 per cent explained by family circumstances.

By and large, the UK tax and benefit system does not alter the importance that each component has in explaining the variation: the results for gross income are similar to those for net income. But there is one exception – the contribution of periods as a lone mother. Our results suggest that only 1.1 per cent of the total variation in net lifetime income is due to episodes of single parenthood, down from the 8.7 per cent for gross income. What this means is that the support provided to women when they are lone parents is particularly well targeted at reducing inequalities in lifetime income, and is potentially a major driver of the lifetime progressivity in the tax and benefit system we identified in Figure 3.4.[18] We now investigate whether this is the case.

3.3 The role of policies targeted towards families with children

Since a disproportionate share of lifetime redistribution is achieved during child-rearing years, we now look at the impact of policies targeted at families with children. In Brewer et al. (2012b),[19] we examined the way each annual UK tax and benefit system from 1991 to 2012 affected inequality in annual and lifetime income. That analysis suggested that changes to the tax and benefit system since 1999 have been important in

[18] Underlying this result is the assumption that changes in taxes and benefits do not affect family decisions such as marriage, divorce and childbearing. To date, empirical evidence on these types of effects is sparse and inconclusive.

[19] Full citation in footnote 2.

bringing about these large lifetime redistributive effects.[20] From 1999 onwards, changes to the tax and benefit system have targeted more resources towards families with children and working families, with the largest increases in generosity for working families with children. In very broad terms, the reforms benefited the poorest half of families with children and made work more financially attractive for lone parents (and, to some extent, for low-paid single adults without children too), but they slightly reduced the reward to working for second earners in couples with children.

Table 3.3 shows the impact these reforms have had on lifetime inequality in gross and net earnings across all women and for the subgroup of the least-educated women.[21] We concentrate on the 1999–2002 period, when the most significant changes took place, and separate the impact on inequality of the work-contingent reform (working families' tax credit, WFTC) and the additional subsidies for families with children (income support, IS) as compared with the pre-reform (1999) tax system.[22]

There is a noticeable fall in inequality in net lifetime income induced by WFTC, and this is particularly strong among women with basic education (second row of Table 3.3). The first two columns of the table allow for women's behavioural responses to the reform. But if we cancel women's behavioural responses, particularly in the form of labour supply, the redistributive impact of WFTC is much attenuated (last two columns).[23] In fact, more than half of the reduction in inequality for the basic education group brought about by WFTC is generated by its impact on moving women, particularly lone mothers, into work. Providing more generous IS

[20] We looked at many other reforms during this period, not all specifically for families, and none had any noticeable lifetime impacts.

[21] The comparison between different tax and benefit systems is performed under the assumption that women and families face the same system for the whole of their lives.

[22] After 2002, work-contingent subsidies were gradually made more generous, thus possibly intensifying the effects we discuss here.

[23] We allow for behavioural responses in education and labour supply, and cancel both decisions when assessing the importance of changes in decisions in driving these results. However, most of the changes we report are driven by the labour supply responses. It should be noted that the employment status and earnings of men in couples are assumed to be exogenous. This means that responses are exclusively driven by female behaviour and the redistributive properties of the reforms.

for families with children has a much more modest effect, hardly contributing to redistribution (compare second and third rows of Table 3.3). Interestingly, however, the redistributive impact of a system with a combination of more generous work-contingent benefits and more generous support for non-working families, as in the third row, is much less driven by labour supply responses. The system remains more strongly redistributive even in the absence of behavioural responses, mainly because the two policies influence the labour supply decisions of the poorest families in opposite directions: WFTC encourages them to enter or stay in work, while IS might influence them to become or remain out of work.

Table 3.3. Gini coefficients for net lifetime income by policy regime, allowing or not for behavioural responses

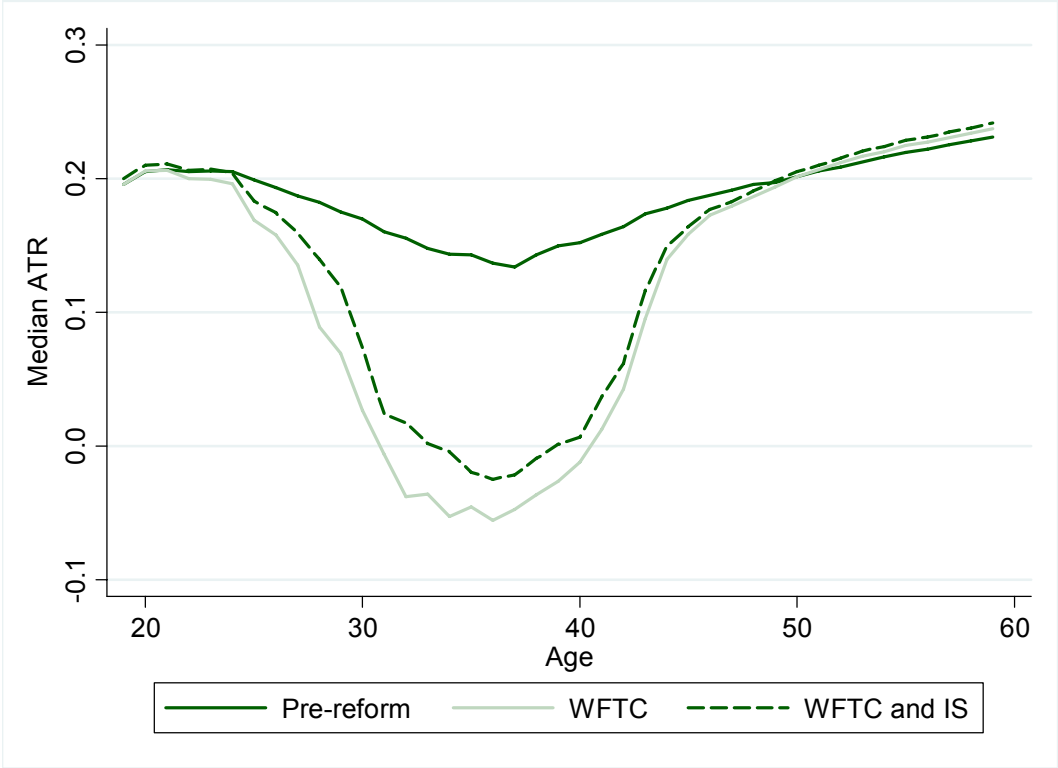
	With behavioural responses		*No behavioural responses*	
	All	*Basic education*	*All*	*Basic education*
Pre-reform Gini	0.192	0.161	0.192	0.161
Impact of WFTC	–0.007	–0.012	–0.003	–0.005
Impact of WFTC and IS for families with children	–0.008	–0.011	–0.006	–0.008

Notes: 'Behavioural responses' refer to female education and labour supply decisions. 'Pre-reform' corresponds to the 1999 tax system; 'WFTC' and 'WFTC and IS' are simulated systems where the work-contingent subsidies and support for families with children have been changed to their 2002 levels. All reforms are revenue neutral, meaning that the basic tax rate is adjusted to keep net revenue raised the same as under the pre-reform system. Gini coefficients are computed for the net lifetime income of all women and for that of the subgroup with basic education, meaning 'GCSEs or lower'.

Figure 3.5 shows the impact on lifetime progressivity that these reforms had. It plots the life-cycle profiles of the median ATR for the bottom quintile of lifetime income and how that ATR depends on the institutional features of the tax and benefit system (the reforms had no visible impact on the top four quintiles, which match the patterns shown in Figure 3.4, so we do not plot them here). The two post-reform profiles – WFTC and WFTC & IS – match closely the pattern identified earlier for the 2006–07 system (Figure 3.4), which shows strong lifetime progressivity taking place during the years women are most likely to live with children. However, Figure 3.5 now shows that this progressivity is brought about by the generous policies for families that characterised the 2000s, and

particularly by the work-contingent benefits. This result is totally consistent with our previous finding, in Table 3.3, that WFTC may have caused a significant reduction in lifetime inequality.

Figure 3.5. Median average tax rate over the life cycle in the bottom quintile of the distribution of lifetime gross income, by policy regime



Notes: 'Pre-reform' corresponds to the 1999 tax system; 'WFTC' and 'WFTC and IS' are simulated systems where the work-contingent subsidies and support for families with children have been changed to their 2002 levels. All reforms are revenue neutral, meaning that the basic tax rate is adjusted to keep net revenue raised the same as under the pre-reform system. The average tax rate is the ratio of family tax liability net of benefits to family gross earnings.

4. Summary of findings, and conclusion

By taking a life-cycle perspective, this project has aimed to enrich our understanding of the impact of the UK tax and benefit system on the incentives to work and earn more, and of the way in which the tax and benefit system redistributes income.

This has been achieved using simulated lifetimes of women (and their families) whose characteristics are taken from survey data and whose behaviour is derived from a model of individual decision-making that broadly replicates what we actually observe amongst real individuals in the UK. This enabled us to go much further than would have been possible

had we simply examined longitudinal data, for two main reasons. First, we were able to examine how work incentives and disparities in income change across the whole of working life, all observed under a constant tax and benefit system. Second, we were able to model how women choose their labour market behaviour in response to the design of the tax and benefit system, including the long-term consequences of decisions made today. As a result, we could calculate a measure of how the tax and benefit system affects the long-run returns to working today, a measure that is more consistent with the forward-looking way in which we think individuals behave. We were also able to show clearly how a tax and benefit system that targets temporary family circumstances, such as lone parenthood, is also able to reduce disparities in lifetime income.

Our key substantive findings were as follows:

- Lone parents tend to face the highest METRs, but low PTRs, reflecting the relatively generous amount of in-work support that is then means-tested away as earnings rise. Women in childless couples generally enjoy the strongest work incentives, because such women are unlikely to be entitled to in-work support and because they are unlikely to be entitled to out-of-work benefits were they not to work. Women in couples with children face METRs that can be higher than those for couples without children, but not as high as those for working lone parents, and they tend to face higher PTRs than lone parents or women in couples without children.
- There are large changes in the fraction of women in work facing very high METRs as women age, with the 75th percentile of METRs for women in the low-education group rising by well over 20 percentage points between ages 20 and 40, before falling back. These life-cycle changes are most pronounced for the low education group. There is also much variation in incentives across individuals' lives.
- A more complete impression of how the tax and benefit system affects work incentives is given by also considering the future consequences of working today (e.g. more experience leading to higher wages) and the possibility that work decisions tomorrow may change as a result. Although for some women – single women without children and high-education women – our impression of whether the tax and benefit system weakens work incentives is not much affected by taking a

dynamic viewpoint, for other groups our impression changes a lot. In particular, the true incentive to work facing lone mothers may be weaker, on average, than a static analysis suggests, partly because lone mothers now will not all be lone mothers in the future and partly because lone mothers tend to face strong incentives to work but weak incentives to earn more. In general, across different levels of education, it is for low-education women that the static and forward-looking measures are most likely to differ. Given that this is the group most likely to be of interest to governments seeking to strengthen work incentives, it emphasises the importance of going beyond standard static measures of work incentives.

- Disparities in gross income are particularly marked amongst women during the main child-rearing years, and they are larger for those with low education than for other groups. Family transitions and the birth of children, and the impact these have on women's labour market behaviour, are at the root of this pattern. However, the UK tax and benefit system is particularly effective at reducing these large inequalities, particularly for women with low education.
- A substantial proportion of lifetime disparities (about 35 per cent) are established at the beginning of working life, driven by characteristics such as wealth, education and ability. A smaller proportion of them arise due to family circumstances during women's lives. Of these, the largest contribution arises from periods of lone motherhood. We find that the UK tax and benefit system is particularly good at ensuring that lone motherhood does not lead to persistent inequalities in lifetime income.
- Changes to the UK tax and benefit system over the last two decades have strengthened its ability to reduce inequalities in lifetime income. The single most important change was the increase in work-contingent support for low-income families with children, beginning with working families' tax credit (WFTC), which was especially powerful in reducing inequality among women in the low-education group. This was partly because it was targeted at those with low income, but also because it increased employment amongst a group with relatively low attachment to the labour market, thus reducing inequality in both gross and net income. Furthermore, because time out of the labour market can have permanent effects on future earnings, encouraging women to work

when children are present can reduce lifetime inequalities as well as cross-sectional ones.

The model we used is necessarily limited in the characterisation of individual circumstances and decisions. One important caveat is that the analysis excluded state benefits and pensions for those over State Pension Age. The fact that some part of pensions is earnings-related, and the fact that there are means-tested benefits for pensioners, mean that benefits provided for pensioners will also affect a forward-looking measure of work incentives, although the direction of bias is unclear. Furthermore, when considered with the taxes levied to fund them, these programmes are clearly a major form of intertemporal redistribution; by excluding them, our results are biased towards finding relatively more interpersonal redistribution than we would have found otherwise. However, it is unlikely that the inclusion of retirement pensions would dramatically alter our main conclusions on the importance of targeting particular life circumstances for lifetime redistribution.

We also excluded childhood and how economic conditions in that period of life might influence subsequent outcomes. Conceivably, accounting for economic conditions during childhood may increase lifetime disparities if these are strong determinants of lifetime outcomes. Alleviating poverty for families may improve the lifetime prospects of children in the most deprived families. Had these mechanisms been taken into account, our results on lifetime inequality and redistribution might have been different, potentially finding that the UK tax and benefit system reduces lifetime disparities by more than we find here.

The consideration of both ends of life defines essential areas for future research. Another priority area of research, still largely unexplored, looks at the impact of taxes and benefits on family-related outcomes, including marriage, divorce and childbearing, and how these may then affect labour supply, income and well-being.